ASSOCIATED RESEARCH, INC.

CALIBRATION PROCEDURE

MODELS 5400DT, 5450DT

HYPOT® AND GROUND CONTINUITY TEST SET

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PART NUMBER 36986

MP MASTER
MA30100

FOREWORD

This calibration and test procedure is written as a single document that can be used to check individual pcb assemblies, as well as calibrate each assembly as part of a complete unit.

The steps in this procedure that are marked with an asterisk (*), are steps used for qualifying the assembly as a functioning assembly. Once the assemblies have been qualified, a chassis with a complete set of functioning pcb assemblies can be properly calibrated by following the steps marked with an ampersand (@). The and sign (&) denotes steps used to verify that a unit is within specified calibration or if the unit needs calibration.

Before any calibration or calibration checking can be performed, a warmup time of approximately 20 minutes is required for a fully assembled chassis.

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POWER AMPLIFIER ASSEMBLY

EQUIPMENT REQUIRED:

Fluke DVM
Hypot unit (5400DT or equivalent)
250k ohm load resistor
HV test leads
HV scope probe (1000:1 divider)
oscilloscope
working 5400/5450DT with calibrated Driver Board Assembly

TEST PROCEDURE

* 1. Short all four terminals of the HVPA unit under test power input connector P402 together. Connect the hypot high voltage cable to P402. Connect the hypot return lead to the HVPA heatsink bracket.

* 2. Perform an AC hypot test on the HVPA unit under test. The unit must withstand 1500VAC for 60 seconds, and leakage must be below 5 ma. Do not exceed 1500 volts during this test. Shut off the hypot unit and disconnect the unit under test. Remove the shorting jumpers from P402.

* 3. Preset R410 (DC ADJ) on the HVPA to the center of its range by turning it 25 turns clockwise and then 10 turns counter-clockwise.

*@ 4. Connect the (-) terminal to TP400 and (+) terminal to L1-2.

*@ 5. Set the DVM to measure volts DC. Turn on the 5400/5450DT power switch. Adjust R410 for +1.9 to +2.1 VDC. Turn off the power to the 5400/5450DT. Apply glyptal to the adjustment pot screw.

*@ 6. Install the HVPA into the 5400/5450DT chassis. Connect the power input module assembly to the HVPA under test. Verify that the power module is set for 115VAC operation and that it has a good 1.6A slow blow fuse installed. Do not connect the HV transformer connector to the HVPA at this time.

* 7. Connect the cable from the high voltage transformer to P401 (OUTPUT) of the HVPA. Connect the high voltage transformer secondary to the 250K load resistor. Connect the high voltage divider across the load and to the oscilloscope. Set the scope to observe 60 Hz sine waves. Turn on power to the 5400/5450DT. Set the unit (5450DT) for AC operation, and set the voltage control to minimum.

* 8. Press the TEST button. Slowly increase the voltage while watching the oscilloscope. Observe a sine wave across the test load. Verify that no noise bursts or ringing are present on the rising or falling edges of the waveform. (Small 'bumps' are acceptable). If noise is seen, note at what voltage and where on the waveform it was seen. Noise on the output is reason for rejection. Otherwise, verify that the output can reach 5KVAC, 20mA without distortion.

HIGH VOLTAGE INTERFACE ASSEMBLY AC/DC

EQUIPMENT REQUIRED:

5450DT Chassis Assembly (tested)
HV meter divider and standard meter
Oscilloscope
DVM
Test leads and jumpers

TEST PROCEDURE

* 1. Visually inspect the 5400DT-19 assembly for proper component placement and assembly per assembly drawing.

* 2. Connect the 10-pin ribbon cable to the 5450DT mother PCB connector. Set the voltage control fully CCW.

* 3. Turn on the 5450DT. Set the AC/DC switch to AC. Verify continuity between the HV XFMR HOT and the HV OUT connectors on the PCB.

* 4. Set the AC/DC switch to DC. Verify no continuity between the points measured in Step 3. Verify continuity through the contacts of K501 and K502.

* 5. Press the TEST button. Verify no continuity through the contacts of K503 while TEST is held depressed. The relay contacts must close when TEST is released.

* 6. Install the 5450DT-19 assembly into the chassis using two screws. Connect all wires to the PCB.

* 7. Connect the HV meter divider to the 5450DT HV output.Set the meter and divider to measure DC kilovolts. Set the 5450DT for a 99 second timed test. Press the TEST button and adjust the voltage control for 5KV output. Verify no arcing is present in the HV compartment. Verify that both panel meters are registering normally on the 5450DT front panel.

* 8. Set the meter to read AC volts. Verify AC ripple of less than 20 volts RMS.

* 9. Press the RESET button. Set the 5450DT AC/DC switch to AC. Set the HV divider and meter to read AC kilovolts. Press the TEST button and adjust the voltage control for 4KV output. Verify no arcing is present in the HV compartment.

* 10. Press the RESET button. Set the voltage control to full CCW position. Press the CONTINUITY button. Verify that K500 clicks

when the button is pressed. Install a short jumper between the RETURN jack and the continuity pin in the HV receptacle. Verify that the READY light comes on when the jumper is installed.

* 11. Turn off the 5450DT and remove the 5450DT-19 PCB assembly from the unit.

* 12. Testing is complete. Pot the finished and tested PCB assembly per the assembly drawing.

MOTHERBOARD ASSEMBLY

EQUIPMENT REQUIRED:

5400DT Chassis
Test and jumper Leads
Keithley DVM or equivalent

TEST PROCEDURE

* 1. Plug power supply connector into mother board P15.

* 2. When there are no plug in board assemblies present in the 5400DT chassis, plug in dummy load card extender into driver board slot.

* 3. Check voltage with DVM between +5 test point TP2 and DGND test point TP3 for voltage between +5.05V and +5.15V.

* 4. Check voltage with DVM between +10 test point TP7 and AGND test point TP4 for voltage between +9.90V and +10.10V.

* 5. Check voltage with DVM between -10 test point TP2 and AGND test point TP4 for voltage between +9.70V and +10.30V.

* 6. Check voltage with DVM between +15 test point TP1 and AGND test point TP4 for voltage between +13.50V and +16.50.

* 7. Check voltage with DVM between -15 test point TP5 and AGND test point TP4 for voltage between -14.55V and -15.45V.

ANALOG PCB ASSEMBLY

EQUIPMENT REQUIRED:

5400DT Chassis
5400DT Extender Card
IC DIP Test Clips
Test and jumper Leads
Precision HV Divider 1000:1 ratio
Keithley DVM
120K ohm 40W load resistor
1 ohm continuity test resistor

TEST PROCEDURE

*@ 1. Insert Analog PCB into the card extender. Plug the card extender into the proper slot in the 5400DT chassis.

* 2. Connect the DVM negative lead to TP306 (AGND) and the positive lead to R300-1. Verify +13 to +16 VDC.

* 3. Connect the DVM positive lead to R307-1. Verify -13 to -16 VDC.

* 4. Connect the DVM positive lead to U305-1. Verify +9.90 to +10.10 VDC.

* 5. Connect the DVM positive lead to U305-7. Verify -9.70 to -10.30 VDC.

* 6. Connect the DVM positive lead to U309-14. Verify +5.0 to + 5.15 VDC.

METER ZEROING

*@ 1. Connect the DVM positive lead to U302-8. Adjust R364 for 000.0 mV dc on DVM.

*@& 2. Front panel Ma meter should read 0.00 Ma in the idle condition.Adjust R357 for 0.00 Ma on front panel mA meter.

*@& 3. Front panel KV meter should read 0.00 KV in the idle condition.Adjust R354 for 0.00 KV on front panel KV meter.

CONTINUITY CURRENT SOURCE

* 1. Set the DVM to indicate DC mA. Move the DVM positive lead to the earth pin on the high voltage socket on the 5400DT front panel. Turn the CONTINUITY button ON and verify 85 to 115

mADC on the DVM. Turn the CONTINUITY button OFF. Remove the DVM leads from the 5400DT.

CONTINUITY DETECTOR

*@& 1. Set the front panel CONTINUITY switch to ON.

*@ 2. Connect the return test cable to the RETURN jack on the front panel, and connect the test clip to the tab of Q300.

*@ 3. Set DVM to read mV DC.

*@ 4. Connect the DVM positive lead to TP302 (CZ) and the negative lead to GND TP306. Adjust R360 (CONT ZERO) for 000.0 mVDC +/- .1mV on DVM. Remove the return test cable from the 5400DT.

*@& 5. Connect the 1 ohm continuity test resistor between the high voltage output socket ground pin and the RETURN jack.

*@& 6. Adjust R361 (CONT SET) counterclockwise until the READY indicator LED goes off. Adjust R361 clockwise until the LED just lights. Remove the test resistor and set the CONTINUITY switch to OFF.

ARC DETECTOR

*@& 1. Move DVM positive lead to TP304 (ARC Z). Adjust R362 (ARC ZERO) for 000.0 mVDC +/- .1 mV on DVM.

*@& 2. Move DVM positive lead to TP305 (ARC S). Adjust R363 (ARC SET) for 1.000 VDC +/- .01V on DVM.

*@ 3. Turn off power and replace Analog Board into chassis.

@& AT THIS POINT IN THE CALIBRATION PROCEED TO LOGIC BOARD FOLLOWED BY THE DRIVER BOARD PG 12 through 19.

FULL SCALE METER ADJUSTMENTS

DRIVER BOARD ASSEMBLY MAXIMUM AC OUTPUT ADJUSTMENT

*@ 1. Set the 5450DT AC/DC switch to AC

*@ 2. Set the Keithley DVM to measure 20VAC. Connect the DVM to the precision divider, and set the divider to measure VAC. Connect the 5400DT leads to the divider input.

*@& 3. Rotate MAX OUT AC trimpot R257 to its full counterclockwise position. Rotate front panel voltage control to its full clockwise (MAX) position. Press test button and adjust MAX OUT AC trimpot R257 for 4.04 V on the Keithley standard.

AC KV METER FULL SCALE ADJUST

*@& 1. Press the TEST button and adjust the output voltage to 4.04 VAC on the DVM. Adjust R355 (ACFSV) for 4.04 kV indication on 5400DT kV meter. Press the RESET switch and turn the voltage control fully counterclockwise.

DRIVER BOARD ASSEMBLY MAXIMUM DC OUTPUT ADJUSTMENT

*@ 1. Set the 5450DT AC/DC switch to DC

*@ 2. Set the Keithley DVM to measure 20VDC. Connect the DVM to the precision divider, and set the divider to measure VDC. Connect the 5450DT leads to the divider input.

*@& 3. Rotate MAX OUT DC trimpot R204 to its full counterclockwise position. Rotate front panel voltage control to its full clockwise (MAX) position. Press test button and adjust MAX OUT DC trimpot R204 for 5.05 V on the Keithley standard.

DC KV METER FULL SCALE ADJUST

*@& 1. Press the TEST button and adjust the output voltage to 5.05 VDC on the DVM. Adjust R356 (DC FS V) for 5.05 kV indication on 5450DT kV meter. Press the RESET switch and turn the voltage control fully counterclockwise. Disconnect the divider from the 5450DT.

AC MA METER FULL SCALE ADJUST

*@ 1. Set the 5450DT AC/DC switch to AC

*@& 2. Set the Keithley DMM to measure 20 mA AC. Connect the DMM between the RETURN jack on the 5400DT and one side of a 120K ohm load resistor. Connect the 5400DT HV lead to the other side of the resistor. Set the DWELL switch for 99 seconds and turn the TIMER switch to ON. Press the TEST button and adjust the output voltage of the 5400DT to indicate 15.000mA on the DMM. Adjust R358 (ACFSM) for 15.00 mA indication on 5400DT mA meter. Press the Reset switch and turn the voltage control fully counterclockwise.

DC MA METER FULL SCALE ADJUST

*@ 1. Set the 5450DT AC/DC switch to DC

*@& 2. Set the Keithley DMM to measure 20 mA DC. Connect the DMM between the RETURN jack on the 5450DT and one side of a 120K ohm load resistor. Connect the 5450DT HV lead to the other side of the resistor. Set the DWELL switch for 99 seconds and turn the TIMER switch to ON. Press the TEST button and adjust the output voltage of the 5450DT to indicate 5.000mA on the DMM. Adjust R359 (DC FS MA) for 5.00 mA indication on 5450DT mA meter. Press the Reset switch and turn the voltage control fully counterclockwise.

AC TRIP POINT VERIFICATION

* 1. Set the 5450DT AC/DC switch to AC

* 2. Connect the load resistor to the 5400DT test cables. Press the TEST button. Adjust the AC HIGH trip adjustment pot fully clockwise. Increase the output voltage until the HIGH FAIL indicator illuminates. Note the indicated current just before the failure. Meter reading must be 15 mA or greater. Turn the voltage control fully counterclockwise and press the RESET button.

* 3. Adjust the AC HIGH trip adjustment pot fully counterclockwise. Press the TEST button and increase the output voltage until the HIGH FAIL indicator illuminates. Note the indicated current just before the failure. Meter reading should be .25 mA or less. Turn the output voltage adjustment fully counterclockwise and press the RESET button. Adjust the AC HIGH trip adjustment pot fully clockwise.

* 4. Press the TEST button and increase output voltage until the mA meter reads 10.00 mA. Turn the AC LOW trip adjustment pot clockwise. The LOW FAIL indicator must illuminate before the AC LOW adjustment reaches the clockwise limit. Turn the output voltage control fully counterclockwise and press the RESET button.

DC TRIP POINT VERIFICATION

* 1. Set the 5450DT AC/DC switch to DC

* 2. Connect the load resistor to the 5450DT test cables. Press the TEST button. Adjust the DC HIGH trip adjustment pot fully clockwise. Increase the output voltage until the HIGH FAIL indicator illuminates. Note the indicated current just before the failure. Meter reading must be 5 mA or greater. Turn the voltage control fully counterclockwise and press the RESET button.

* 3. Adjust the DC HIGH trip adjustment pot fully counterclockwise. Press the TEST button and increase the output voltage until the HIGH FAIL indicator illuminates. Note the indicated current just before the failure. Meter reading should be .25 mA or less. Turn the output voltage adjustment fully counterclockwise and press the RESET button. Adjust the DC HIGH trip adjustment pot fully clockwise.

* 4. Press the TEST button and increase output voltage until the mA meter reads 5.00 mA. Turn the DC LOW trip adjustment pot clockwise. The LOW FAIL indicator must illuminate before the DC LOW adjustment reaches the clockwise limit. Turn the output voltage control fully counterclockwise and press the RESET button.

RAMP VOLTAGE VERIFICATION

*@ 1. For 5450DT set AC/DC switch to AC.

*@ 2. Press TEST and raise voltage to 4 KV AC.

*@ 3. Set TIMER to "ON" RAMP time for 00 second DWELL time for 02.

*@ 4. Connect HV output to HV divider.

*@ 5. Connect digital storage scope probe to divider outputs.

*@ 6. Press test button and store output waveform.

*@ 7. Check output waveform for overshoot. The peak value of the envelope should not exceed the steady state value by more than 5%.

*@ 8. Remove divider and scope.

*@ 9. Set TIMER to "ON" RAMP time for 01 second DWELL time for 02.

*@ 10. Press TEST button and check KV meter to see that the voltage reaches 4 KV just before or when the dwell time begins.

*@ 11. Repeat step 10 at RAMP times of 2, 4, 8, 10, 20, 40, and 80 seconds.

@& AT THIS POINT IN THE CALIBRATION PROCEED TO REAR PANEL ADJUSTMENTS PG 20.

LOGIC PCB ASSEMBLY

EQUIPMENT REQUIRED:

5400DT Chassis
5400DT Extender Card
14-pin and 16-pin DIP Test Clips
Jumper wires with clips
Digital multimeter (Fluke Model 83 or equivalent)
Digital counter/timer (Sanwa 8100LG or equivalent)

INITIAL TEST SETUP

* 1. Turn off the Continuity switch.

* 2. Turn off the Timer switch.

* 3. Set the Ramp timer to 01

* 4. Set the Dwell timer to 01.

*@ 5. Insert the card extender into the 5400DT chassis and plug the Logic PCB Assembly into the card extender.

*@ 6. Attach a 14-pin DIP clip to U114 (see Note 1 below).

*@ 7. Connect U114-1 (EOR) to U114-7 (GND) with a jumper (see Note 1 below).

NOTE 1: If the driver board is installed, skip steps 6 and 7 above.

TEST PROCEDURE

* 1. Turn on the power. The READY indicator should light.

* 2. Check for +4.75 to 5.25 VDC from TP100 (+5) to TP101 (DGND).

* 3. Attach a 14-pin DIP clip to U118.

* 4. Connect U118-4 (*CD) to U118-7 (GND).

* 5. Turn the Continuity switch ON.
The yellow indicator should light
The READY indicator should turn off.

* 6. Press the TEST switch.
The ALARM should sound
MASTER FAIL should light
CONT FAIL should light

* 7. Press the RESET switch.
The ALARM and FAIL lights should go out.

* 8. Disconnect U118-4,7.

* 9. Turn the Continuity switch OFF.
The yellow indicator should turn off

* 10. Press and hold the TEST switch.
The HV ON indicator should flash.

* 11. Release the TEST switch.
The HV ON indicator should turn off.
The READY and PASS indicators should light.

* 12. Turn the Timer switch ON.
The white indicator should light.

* 13. Press and release the TEST switch.
If driver board is installed RAMP light should light for about 1 sec. and then turn off. If jumper was used instead of driver board Ramp light will not light.
The DWELL indicator should light for about 1 sec. and then turn off.
The HV ON indicator should flash.
The PASS indicator should light when DWELL turns off.

* 14. Move the 14-pin DIP clip from U118 to U112 and connect U112-9 (HD) to U112-7 (GND).

* 15. Press TEST.
ALARM, MASTER FAIL, and HIGH FAIL should light.
Press RESET to turn them off.
Disconnect U112-9.

* 16. Connect U112-5 (LD) to U112-7 (GND).

* 17. Press TEST.
ALARM should sound.
MASTER FAIL, and LOW FAIL should light.

* 18. Press RESET to turn them off.
Disconnect U112-5.

* 19. Connect U112-3 (AD) to U112-7 (GND).

* 20. Press TEST.
ALARM should sound.
MASTER FAIL, and ARC FAIL should light.

* 21. Press RESET to turn them off.
Disconnect U112-3.

* 22. Attach a 16-pin DIP clip to U104.

* 23. Connect U104-15 (RAMP) to U104-8 (GND).
The RAMP indicator should light.

* 24. Remove dip clips and test leads

DWELL TIMER CALIBRATION

*@ 1. Plug the SANWA frequency counter/timer line cord into a 115V outlet and turn on the power switch.

*@ 2. Set the frequency counter/timer for INTERVAL measurement.

*@ 3. Connect the Red test lead into channel 1 and the black test lead into channel 2.

*@ 4. Set Channel 1 to NONINVERT mode. Set Channel 2 to INVERT mode.

*@ 5. Set the MANU/AUTO switch to MANU mode.

*@ 6. Set the Red Time switch IN and the Blue Frequency switch OUT.

*@ 7. Set the time range for 0.000 sec.

*@ 8. Connect the Red and Black test clips together and connect them to TP108 (DWELL). Connect -COM to TP101 (DGND).

*@ 9. Set the Timer switch ON and DWELL TIME for 1 seconds.

*@ 10. Press and release the MEASURE switch on the SANWA counter/timer to initialize the elapsed time to 0.000.

*@ 11. Press and release the Test switch. The SANWA counter/timer will measure the DWELL time interval. Adjust R100 (TIMER) CW to increase the time or CCW to decrease the time. Repeat steps 10 and 11 until the DWELL time is 1.000 + 1% seconds.

*@& 12. Check DWELL time at the 2,4,8,10,20,40 and 80 second settings. The measured time should be + 1% of that indicated on the DWELL TIME switch.

*@ 13. Apply glyptal to R100.

*@ 14. END OF TEST. Turn off the power and remove the DIP clips and jumpers.

*@ 15. Remove extender card and replace logic board in chassis.

DRIVER PCB ASSEMBLY

EQUIPMENT REQUIRED:

Extender card
14 pin dip test clip
Test leads with clips
DVM FLUKE model 83 or equivalent
Oscilloscope with isolated ground line cord
SANWA 8100LG Frequency counter-timer.

RAMP TIME ADJUSTMENT

*@ 1. Connect line cord of frequency counter-timer to 115 V supply and set power switch to "ON".

*@ 2. Set frequency counter-timer for INTERVAL measurement.

*@ 3. Connect Red test lead into channel 1 and black test lead into channel 2.

*@ 4. Place channel 1 in NONINVERT mode. Place channel 2 in INVERT mode.

*@ 5. Place MANU/AUTO switch in MANU mode.

*@ 6. Place Red Time switch "IN" and Blue Frequency switch "OUT".

*@ 7. Set range for 0.000 (sec.).

*@ 8. Connect Red and Black test clip together and connect RAMP test point TP107 on LOGIC BOARD PN 36731 connect (-com) to DGND test point TP200

*@ 9. Set timer switch "ON", RAMP TIME for 1 second and DWELL TIME for 0 seconds.

*@ 10. Adjust RTIME trim pot R207 for 1.000 + .001 second on the Sanwa timer.

*@& 11. Check times at 2,4,8,10,20,40 and 80 second settings. Time should be + 1% of that indicated on RAMP TIME switch.

*@ 12. Remove all connections to Sanwa meter.

CALIBRATION PRESET

*@ 1. Disconnect PWR AMP cable J400 from mother board connector P14.

*@ 2. Remove Driver Board from chassis and place in extender card.

*@ 3. If calibrating 5450DT place AC/DC switch in DC mode.

*@ 4. Turn power switch on.

*@ 5. Monitor voltage at pins indicated with reference to AGND test point TP208 and trim associated null pot to 0.00 V +/- .01 V DC.

IC Pins	Null pots
U200-12	1XNL R200
U200-8	1YNL R201
U201-12	2XNL R203
U201-8	2YNL R273

*@ 6. Remove Driver Board from extender card and replace into chassis.

RAMP MULTIPLIER ADJUSTMENT

*@ 1. Set timer switch "ON", RAMP TIME for 2 second and DWELL TIME for 5 second.

*@ 2. Set voltage adjust on the front panel at maximum clockwise position.

*@ 3. Monitor SETPT test point TP202 with DC DVM, with reference to AGND test point TP208.

*@ 4. Rotate MAX OUT, AC trim pot R257 to full clockwise position . Rotate MAX OUT, DC trim pot R204 to full clockwise position .

*@ 5. If calibrating 5450DT place AC/DC switch in AC mode.Voltage should be between -4.8V and -5.2V DC, for 5450DT AC mode or 5400DT.

*@ 6. If calibrating 5450DT place AC/DC switch in DC mode.Voltage should be between -4.8V and -5.2V DC.

*@ 7. Set voltage adjust on the front panel at maximum counterclockwise (MIN) position.

*@& 8. Model 5450DT should be left in DC mode for calibration.

*@ 9. Monitor voltage at RMP OUT testpoint TP204 and adjust RMP MULT pot R205 for a voltage between -100.0 mV and -300.0 mV.

*@& 10. Monitor voltage at RMP OUT testpoint TP204 and adjust 1XNL pot, R200. Note reading before TEST. Press Test button. Check reading during DWELL cycle and adjust R200 for the reading that was noted before the test.

@& 11. Repeat STEP 10 until voltage before test and during DWELL cycle are equal +/- 1 mV.

@& 12. With DC DVM, monitor RMP OUT test point TP204 when unit is in the idle state. Note voltage reading with voltage control at maximum counterclockwise (MIN) position. Rotate voltage control to maximum clockwise then adjust 1YNL trimpot, R201 for the voltage noted at MIN position.

*@ 13. Repeat STEP 12 until voltage at min and max positions are equal +/- 1 mV.

*@ 14. Repeat step 10 through 13 until you can return to this step having made no further adjustments.

*@ 15. If ANALOG BOARD is not installed in HYPOT a jumper will be needed for the following STEPS. Jumper from AGND testpoint TP208 to U205-5. If ANALOG BOARD is installed continue with procedure.

*@& 16. Monitor voltage at SUM test point, TP205 with DC DVM and adjust RMP MULT pot R205 for smallest positive voltage. Note the smallest voltage that is reached. Take care not to overrotate trimpot in counterclockwise direction.

*@& 17. Set RAMP TIME for 10 seconds and DWELL TIME for 2 seconds and voltage control at MIN position.

*@& 18. Set DVM to mV scale.

*@& 19. Press test button and check for any change in voltage noted during STEP 16. Voltage should remain constant throughout the RAMP and DWELL test cycle, within 2mV.

*@ 20. Trim any deviation larger than 2 mV seen in STEP 19 by rotating RAMP MULT pot R205, counterclockwise one eighth of a turn and repeat STEP 19.

@ 21. Recheck STEP 19 and 20 for proper adjustment.

@& 22. For model 5450DT switch to AC mode and check step 19 and 20.

OSCILLATOR ADJUSTMENT

*@& 1. For model 5450DT set AC/DC switch to AC mode.

*@& 2. Monitor OSC test point TP206 with a frequency counter and adjust AC HZ, 60, pot R252 for a frequency of 60 Hz +/- .1 Hz.

*@& 3. Jumper pads at P200 to switch to 50 Hz.

*@& 4. Monitor OSC test point TP206 with a frequency counter and adjust AC HZ, 50, pot R202 for a frequency of 50 Hz +/- .1 Hz.

*@& 5. Return to STEP 1 and repeat procedure until both settings are within +/- .1 Hz

AC MULTIPLIER ADJUSTMENT

*@ 1. For model 5450DT set AC/DC switch to DC mode.

*@ 2. Monitor voltage at PADRV test point TP207 with AC DVM.

*@ 3. Adjust 2XNL trimpot R203 for minimum voltage on the DVM. Note as R203 is rotated in one direction the voltage will decrease, reach a minimum and then begin to increase.

*@ 4. Monitor voltage at PADRV test point TP207 with DC DVM. Set DVM to mV scale.

*@ 5. Adjust AC MULT trimpot R206 for 000 mV dc +/- 10 mV.

*@ 6. Set timer switch "ON", RAMP TIME for 00 seconds and DWELL TIME for 30 seconds

*@ 7. Set voltage control on front panel to MIN position.

*@ 8. Monitor voltage at PADRV test point TP207 with AC DVM.

*@ 9. Press test button and rotate voltage control clockwise until an AC voltage of 7.5 to 8.0V on DVM is reached, if voltage control is rotated to far clockwise the voltage will begin to decrease.

*@ 10. While test is still in process, switch DVM to DC V scale and adjust 2YNL trimpot R273 for 0.000 V DC +/- .050 V.

@ 11. Return to STEP 1. and recheck adjustment. Recalibrate where necessary.

FINAL CALIBRATION

@& 1. Monitor voltage at PADRV test point TP207 with an ungrounded, (floating) oscilloscope set on smallest V/div range. Use AGND test point TP208 as a reference (ground).

@& 2. Adjust 2XNL trimpot R203 for minimum AC ripple.

@& 3. Adjust ACMULT trimpot R206 for minimum DC offset.

@ 4. Turn off power. Rotate voltage control to max counterclockwise position (MIN).

@ 5. Replace PWR AMP cable J400 to mother board connector P14.

@ 6. Glyptal all pots except for MAX OUT AC and MAX OUT DC.

@& AT THIS POINT IN THE CALIBRATION, RETURN TO THE ANALOG BOARD FOR FULL SCALE METER ADJUSTMENT PG 8 .

REAR PANEL ADJUSTMENTS

REMOTE INTERFACE PCB ASSEMBLY

EQUIPMENT REQUIRED:

DVM FLUKE model 83 or equivalent
0-12V DC POWER SUPPLY

REMOTE KV METER ADJUSTMENT

*@& 1. Set the 5450DT AC/DC switch to AC

*@& 2. Monitor KV(+) test point TP1 to KV(-) test point TP2 with DC DVM.

*@& 3. With Hypot in idle state and front panel meter KV meter reading of 0.00, adjust KV ZERO trim pot R706 for 0.000v on the DVM.

*@& 4. Set timer switch "ON", set RAMP TIME for 00 seconds and DWELL TIME for 99 seconds.

*@& 5. Press test button and adjust voltage on front panel for 4.00 kV.

*@& 6. Adjust KV FS trim pot R700 for 2.00V on DVM.

*@ 7. Repeat steps 2 through 6 and check for proper adjustment.

@ 8. Check tracking at 3.00, 2.00, 1.00, .60, .40 kV. Reading on DVM should be .5 times that on front panel +/- 1%.

REMOTE MA METER ADJUSTMENT

*@& 1. Monitor MA(+) test point TP3 to MA(-) test point TP4 with DC DVM.

*@& 2. With Hypot in idle state and front panel meter KV meter reading of 0.00, adjust MA ZERO trim pot R704 for 0.000v on the DVM.

*@& 3. Set timer switch "ON", set RAMP TIME for 00 seconds and DWELL TIME for 99 seconds.

*@& 4. Press test button and adjust voltage on front panel for 15.00 mA.

*@& 5. Adjust MA FS trim pot R701 for 7.50 V on DVM.

*@ 6. Repeat steps 2 through 5 and check for proper adjustment.

@ 7. Check tracking at 1 mA increments down to .5 mA. Readings on DVM should be .5 times that on front panel +/- 1%.

REMOTE VOLTAGE SET INPUT TEST

* 1. Set timer switch "ON", set RAMP TIME for 00 seconds and DWELL TIME for 99 seconds.

* 2. Jumper Remote Select inputs on rear panel Interface Connector pins 9 and 22.

* 3. Press the test button and rotate the voltage control clockwise. Check to see that the front panel voltage adjustment has been disabled by viewing the kilovolt meter.

* 4. Connect a 0 to 12 volt dc power source to the Remote Voltage Set inputs pins, positive pin 10 and negative pin 23.

* 5. Set voltage for 0 volts dc.

* 6. Press test button and raise voltage to 10.00Vdc, output voltage of Hypot should reach maximum specified voltage.

AC FACTORY SETTINGS

(Note: Factory settings should be done as a last step when calibration and specification data are checked)

1. Press the TEST button and adjust the output voltage for 5.00 mA indicated on the 5400DT mA meter. Adjust the AC HIGH FAIL adjustment pot clockwise until the HIGH FAIL indicator illuminates. Lock the AC HIGH FAIL pot setting at this point. Set the output voltage control fully counterclockwise and press the RESET button.

2. Set the AC LOW TRIP pot fully clockwise. Press the TEST button and increase the output voltage for 0.50 mA indicated on the 5400DT mA meter. Adjust the AC LOW trip pot counterclockwise until the unit indicates a LOW FAIL. Lock the AC LOW FAIL pot at this point. Return the output voltage control to its fully counterclockwise position and press the RESET button.

DC FACTORY SETTINGS

(Note: Factory settings should be done as a last step when calibration and specification data are checked)

1. Press the TEST button and adjust the output voltage for 1.00 mA indicated on the 5450DT mA meter. Adjust the DC HIGH FAIL adjustment pot clockwise until the HIGH FAIL indicator illuminates. Lock the DC HIGH FAIL pot setting at this point. Set the output voltage control fully counterclockwise and press the RESET button.

2. Set the DC LOW TRIP pot fully clockwise. Press the TEST button and increase the output voltage for 0.50 mA indicated on the 5400DT mA meter. Adjust the DC LOW trip pot counterclockwise until the unit indicates a LOW FAIL. Lock the DC LOW FAIL pot at this point. Return the output voltage control to its fully counterclockwise position and press the RESET button.

3. Test is complete. Turn off 5450DT power and apply glyptal to all adjustment pots for final calibration. For board test, remove the analog PCB from the card extender and place it into a static protection bag.

FINAL TEST PROCEDURE
USE SPECIFICATION DATA SHEET WHEN FOLLOWING THIS PROCEDURE

HIPOT TEST

A. EQUIPMENT NEEDED:

1. 5400DT AC Hypot Test Set.

B.INITIAL SETUP

1. Plug the hipot test set into a 115VAC outlet and turn on the power. Let the hipot warm up for 10 minutes.

2. Set high voltage output to 1500VAC.

3. Set high current trip point to 10 ma.

4. Set low current trip point to .5 ma.

5. Set Ramp timer to 1 sec.

6. Set Dwell timer to 60 sec.

7. Set the Continuity Switch and Timer Switch to the ON position.

C. TEST PROCEDURE

1. Plug the line cord of the Item Under Test (IUT) into the high voltage receptacle on the hipot test set.

2. Connect the return lead from the hipot test set to the IUT chassis ground post located on the rear panel.

3. Set the IUT power switch to the ON position.

4. Press and release the hipot Test Switch. There should be no arc breakdown, leakage or continuity failures indicated.

LINE REGULATION

A. EQUIPMENT NEEDED

1 100-260VAC variable voltage source
2. Line voltage meter
3. Clamp-on current meter
4. 267K 60W load resistor
5. 1M 25W load resistor
6. AC/DC output voltage meter
7. High voltage divider

B. INITIAL SETUP

1. Connect the IUT to the variable voltage AC source
2. Connect the line voltage meter across the output of the AC source.
3. Connect the clamp-on line current meter to the AC source.
4. Connect the high voltage divider and output voltage meter across the output of the IUT.
5. Connect the load resistor across the high voltage output of the IUT (267K for AC, 1M for DC).
6. Set the voltage control of the IUT for minimum output.

C. TEST PROCEDURE

1. Set the AC source for 115VAC.
2. Check the voltage selection on the IUT to be sure it is set for 110-120VAC operation. Turn on the IUT.
3. Press the Test switch and set the high voltage output to 4000VAC for an AC test or 5000VDC for a DC test.
4. Measure the line current.
5. Decrease the AC voltage to 100VAC.
6. Press the Test Switch and measure the line current and output voltage.
7. Increase the AC voltage to 130VAC and repeat step 6.
8. Turn off the IUT power switch.
9. Unplug the line cord from the power entry module and set the IUT for 220-240VAC operation. Plug the line cord into the power entry module.
10. Set the AC source for 230VAC.
11. Repeat step 3 and 4.
12. Decrease the AC voltage to 200VAC and repeat step 6.
13. Increase the AC voltage to 260VAC and repeat step 6.
14. Turn off the IUT power switch. Unplug the line cord and reset the IUT for 110-120VAC operation. Plug the line cord into the power entry module.

LOAD REGULATION

A EQUIPMENT NEEDED

1 100-260VAC variable voltage source
2. Line voltage meter
3. Multipal resistor load box
4. AC/DC output voltage meter
5. High voltage divider

B. INITIAL SETUP

1. Connect the IUT to the variable voltage AC source
2. Connect the line voltage meter across the output of the AC source.

3. Connect the high voltage divider and output voltage meter across the output of the IUT.
4. Connect the load resistor across the high voltage output of the IUT (120K for AC, 489K for DC).
5. Set the voltage control of the IUT for minimum output.

C. TEST PROCEDURE

1. Set the AC source for 115VAC.
2. Check the voltage selection on the IUT to be sure it is set for 110-120VAC operation. Turn on the IUT.
3. Press the Test switch and set the high voltage output to 1800VAC for an AC test or 2500VDC for a DC test.
4. Press reset button and take care to leave voltage control setting at position from step 3.
5. Replace load with across the high voltage output of the IUT (2M for AC, no load for DC).
6. Press test button and record voltage measured at the new load.
7. Press reset button to deenergize the output.
8. Set AC source for 230VAC.
9. Turn off IUT. Remove voltage selection block from input module and replace it in the 230VAC position. Turn on IUT.
10. Repeat steps 3 through 7.

KILOVOLT METER (front panel and remote)

A. EQUIPMENT NEEDED

1. AC/DC output voltage meter
2. High voltage divider
3. DVM

B. INITIAL SETUP

1. Connect high voltage divider and meter to output of IUT.
2. Connect DVM to remote KV meter output terminals 11 (+) and 24 (-).
3. Set voltage control to minimum.
4. Set timer switch "ON", RAMP TIME for 00 and DWELL TIME for 99.

C. TEST PROCEDURE

1. Press test button and adjust voltage on front panel for voltages indicated in table. Record voltages from KV standard and remote DVM in table.
2. Repeat procedure for DC mode.

3. Turn high trip pot to minimum.
4. Press the test button and raise the voltage while monitoring the front panel mA meter, until a high fail is generated. Note current at which the unit fails and record in the table for high trip min.
5. Repeat procedure for DC.

LOW CURRENT TRIP POINT

A. EQUIPMENT NEEDED

1. Multipal resistance load box

B. INITIAL SETUP

1. Connect load resistor to high voltage output.(120K for AC, 648K for DC.)
2. Turn HIGH trip pot to maximum clockwise position.
3. Turn LOW trip to maximum counterclockwise position.
4. Turn voltage control to minimum.
5. Press test button and raise the current to a level just below the max high trippoint.
6. Press the reset button, and leave voltage control setting at that point.
7. Rotate LOW trip point pot to its maximum clockwise position.

C. TEST PROCEDURE

1. Press the test button and decrease the voltage while monitoring the front panel mA meter, until a low fail is generated. Note current at which the unit fails and record in the table for low trip max.
2. Repeat procedure for DC.
3. Turn low trip pot to minimum.
4. Replace load with 2M ohms or similar value.
5. Press the test button and raise the voltage while monitoring the front panel mA meter. Set current to .1mA. While current is stable at .1mA, reach back to the rear panel and rotate the low trip pot clockwise until a low failure is generated.
6. Repeat procedure for DC.

CONTINUITY TRIP

A. EQUIPMENT NEEDED

1. Calibrated 1 ohm resistor

B. INITIAL SETUP

1. Turn continuity button "ON".

2. Plug in 1 ohm resistor between ground return and ground pin on front panel HV receptacle.

C. TEST PROCEDURE

1. Ready indicator should be lit.
2. Pull one side of the 1 ohm resistor from its jack.
3. Ready indicator should turn off.
4. Press the test button. The Continuity fail indicator should light and alarm should sound.
5. Press reset and replace 1 ohm resistor.
6. Press test, HV should initialize.
7. Press reset. Test complete.

ARC TRIP

A. EQUIPMENT NEEDED

1. IUT plus test leads

B. INITIAL SETUP

1. Timer "ON", RAMP TIME 00, DWELL TIME 99.
2. Place HV lead on bench away from all other objects
3. Hold ground return lead in one hand.

C. TEST PROCEDURE

1. Press test button and adjust for voltage in table. With voltage energized, touch ground lead to HV lead to generate failure.
2. Note in table which failure(s) occurred.
3. Press reset and continue with following voltage.
4. Repeat procedure for DC.

RAMP TIME

A. EQUIPMENT NEEDED

1. Stop Watch

B. INITIAL SETUP

1. Set Timer "ON", RAMP TIME 01, DWELL TIME 00.

C. TEST PROCEDURE

1. Press test button and start stop watch simultaneously. Stop the stop watch when the RAMP light goes out on completion of TEST.

2. Compare times with those in the table.

DWELL TIME

A. EQUIPMENT NEEDED

1. Stop Watch

B. INITIAL SETUP

1. Set Timer "ON", RAMP TIME 00, DWELL TIME 01.

C. TEST PROCEDURE

1. Press test button and start stop watch simultaneously. Stop the stop watch when the DWELL light goes out on completion of TEST.
2. Compare times with those in the table.

REMOTE INTERFACE

A. EQUIPMENT NEEDED

1. Interface cable test fixture
2. DMM with ohms
3. 0-12V DC Power supply

B. INITIAL SETUP

1. Plug in the test fixture to the 25pin D subminiature socket on the rear panel.
2. Turn timer "OFF".

C. TEST PROCEDURE.

1. Generate a switch closure between pins 1 and 14. See that test has initialized.
2. Remove switch closure.
3. Turn timer "ON". Voltage control at minimum.
4. Set Dwell Time for 10 seconds.
5. Press Test.
6. Generate switch closure between pins 2 and 15. See that test has deenergized.

7. Connect ohmmeter between points indicated below and generate a failure associated with the contacts in question. See that before the failure the ohmmeter shows an open circuit. After the failure the meter should indicate a short. Press reset after each failure.

High fail	Pins 5 to 18
Low fail	Pins 6 to 19
Arc fail	Pins 7 to 20
Continuity fail	Pins 8 to 21

8. Turn timer "OFF".
9. Connect the ohmmeter between pins 4 and 17.
10. Press and release test button generating no failures. The Pass light on the front panel should illuminate. The ohmmeter should indicate a short.
11. Connect the ohmmeter between pins 3 and 16.
12. Meter should indicate open circuit.
13. Press Test and note HV ON light on front panel. Ohmmeter should show short circuit. Release Test.
14. Set timer switch "ON", set RAMP TIME for 00 seconds and DWELL TIME for 99 seconds.
15. Jumper Remote Select inputs on rear panel Interface Connector pins 9 and 22.
16. Press the test button and rotate the voltage control clockwise. Check to see that the front panel voltage adjustment has been disabled by viewing the kilovolt meter.
17. Connect a 0 to 12 volt dc power source to the Remote Voltage Set inputs pins, positive pin 10 and negative pin 23.
18. Set voltage for 0 volts dc.
19. Raise voltage to those specified in the table and record output voltage on the front panel KV meter.

SPECIFICATIONS

MODEL	5450DT
DESCRIPTION	AC/DC Hypot® and Ground Continuity Test Set
PRIMARY APPLICATION	Manufacturing [illegible] production line testing of commercial and consumer products to meet UL, [illegible], [illegible] requirements where dielectric voltage-withstand and ground continuity tests are specified.
INPUT	100-130VAC, 50/60Hz, Single phase, 1.0A Max. 200-260VAC, 50/60Hz, Single phase, .5A Max User selectable
FUSE	1.6A 250V SLO BLO 5 x 20 mm (Buss GDC-1.6A)
OUTPUT VOLTAGE	0-5KVAC, 0-5KVDC continuously adjustable. Zero-crossing turn-on. No transients exceeding 105% of peak value. 1% regulation over line input range and 120K to 2M load.
OUTPUT CURRENT	0-15mA AC, 0-5mA DC
HIGH TRIP CURRENT RANGE	.25-15mA AC, .25-5mA DC adjustable with multi turn pot. Factory set to 5mA AC, 1mA DC
LOW TRIP CURRENT RANGE	.1-10mA AC, .1-5mA DC adjustable with multi-turn pot. Factory set to 0.0mA AC and DC.
CONTINUITY TRIP	1 ohm maximum at .1A.
FAILURE DETECTOR	Audible and visual
RAMP TIMER	0-99 Seconds in 1 second increments
DWELL TIMER	0-99 Seconds in 1 second increments
KILOVOLT METER	0-19.99 digital. 1% accuracy [illegible] Significant Digit.
MILLIAMP METER	0-19.99 digital 1% accuracy ±1 least Significant Digit
SIZE (W X H X D)	7 X 7.5 X 14 [illegible]
WEIGHT	25 pounds.

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SPECIFICATIONS

MODEL	5400DT
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PRIMARY APPLICATION	Manufacturing and production line testing of commercial and consumer products to meet UL, CSA, and other safety agency requirements where dielectric voltage-withstand and ground continuity tests are specified.
INPUT	100-130VAC, 50/60hz, Single phase, 1.0A Max. 200-260VAC, 50/60Hz, Single phase, .5A Max. User selectable.
FUSE	1.6A 250V SLO BLO 5 x 20 mm (Buss GDC-1.6A)
OUTPUT VOLTAGE	0-4KVAC, Continuously adjustable. Zero-crossing turn-on. No transients exceeding 105% of peak value. 1% regulation over line input range and 120K to 2M load.
OUTPUT CURRENT	0-15mA
HIGH TRIP CURRENT RANGE	.25-15mA adjustable with multiturn pot. Factory set to 5ma.
LOW TRIP CURRENT RANGE	.1-10mA adjustable with multiturn pot. Factory set to .5ma.
CONTINUITY TRIP	1 ohm maximum at .1A.
FAILURE DETECTOR	Audible and visual
RAMP TIMER	0-99 Seconds in 1 second increments
DWELL TIMER	0-99 Seconds in 1 second increments
METERING Kilovolt	0-19.99 digital. 1% accuracy ±1 Least Significant Digit.
Milliamp	0-19.99 digital. 1% accuracy ±1 Least Significant Digit.
SIZE (W X H X D)	17 X 7.5 X 14.5 inches.
WEIGHT	23 pounds.

MP MASTER
MA30100